deserves more than a passing notice in our columns. To name one only of his many claims to scientific recognition, he commenced meteorological observations in Stromness in the year 1822, and continued them, either there or in the adjacent parish of Sandwick, to within a fortnight of his death in 1884.

He belonged to the old Norse stock in Orkney, coming from the township of Clouston in Stennis. Two families of this name now live in the township, having succeeded to their farms, by direct descent, for over 400 years. He studied in Edinburgh University, and had at first been destined for the medical profession. He became a Licentiate of the R.C.S. in Edinburgh in 1819, and at his death was probably the father of the College. When in 1826 he entered on his duties as assistant and successor to his father, in the combined parishes of Stromness and Sandwick, there was no medical man in the latter place. For nearly fifty years he acted as the local doctor, in addition to his clerical duties, giving advice and medicines *gratis*. His father had been minister of Stromness for over sixty years, so that father and son had kept up a continuous ministry for 120 years. He received the degree of LL.D. from the University of St. Andrew's many years ago.

In the year 1862 Dr. Clouston's reputation as a careful meteorological observer was so well established that Admiral FitzRoy intrusted to his charge an anemometer, which has been kept in constant operation for the space of twenty-two years. The original instrument was replaced by a new one in 1869. A discussion of the results of the first five years' records (1863-68) appeared in the *Quarterly Weather Report* for 1871. In addition to his regular observations and deductions therefrom, which he occasionally published, he wrote an essay, "An Explanation of the Popular Weather Prognostics of Scotland, on Scientific Principles," which gained the prize allotted by the Marquis of Tweeddale in 1867. His observations for the last thirty years, at least, have been regularly published by the Registrar-General for Scotland.

Dr. Clouston was not only a meteorologist, but an ardent follower of every branch of science which came in his way. In his "Guide to the Orkney Islands," a reprint of a portion of "Anderson's Guide," he modestly says, "Taking the Orkney Flora, as Dr. Neill left it, to include 462 specimens, and adding our own contribution of 156, it now contains 618 species." In archæology he took an active part in the exploration of Maes How, and the House of Skaill, both of them within a walk of his home.

Dr. Clouston leaves a widow, two sons, and two daughters, but more than one member of his family passed away before him. In conclusion, we can only say that a visit to Sandwick was ever a rare treat; the warm hospitality of the manse, and the interest of the conversation carried on round the table, could not fail to leave an impression which will not easily wear away.

## ON THE AUTUMNAL TINTS OF FOLIAGE

AFTER the fine display of autumnal tints which we have lately seen it may, I trust, be of interest to some of the readers of NATURE if I give an account of the chief conclusions to which I have been led by carefully studying the subject for many years.

As a general rule the colour of leaves in their normal condition depends on a variable mixture of two perfectly distinct green pigments and of at least four perfectly distinct yellow substances. The development of the autumnal tints is mainly due to the disappearance or change of the green constituents and to the production of highly-coloured pigments by the oxidisation of previously existing very pale or colourless substances. It is, in fact, due to a more or less complete loss of the vitality which previously counteracted these chemical changes, and the order in which the tints are developed can be easily explained, if we assume that the death of the leaves takes place somewhat gradually. The first visible effect of the reduced vitality is the change in the green pigments. In many cases they appear to be converted into colourless products, since the resulting bright yellow leaves differ from the normal green in the absence of chlorophyll, and merely contain the usual previously-existing yellow pigments. At the same time it is quite possible that an increased quantity of some of these yellow substances may be formed as a product during the change, but of this there is no positive proof. In the case of such trees as the alder, the chlorophyll does not thus disappear, but is changed by the presence of a weak acid into a very stable brownish-green product which resists further change. The production of bright yellows or dull browns thus clearly depends on whether the chlorophyll does or does not disappear before being modified by the action of acids, as may be verified experimentally by exposing suitable solutions to sunlight. It is, however, very clear that the manner in which it changes depends very much on the conditions of the case. Thus, if chlorophyll is exposed to sunlight dissolved in bisulphide of carbon, a reddish-coloured product is formed, and though this differs very greatly from the red pigment met with in many autumnal leaves, it seems probable that under some conditions the chlorophyll in leaves is changed by the action of light into a red substance. By taking green sorrel leaves and keeping them somewhat fresh by sticking the stalks into moist ground, I found that those exposed to the sun with the under side upwards turned to a bright red, whereas those kept in the shade did not develop any fine colouring. We may often see that partially broken leaves or twigs undergo this change when all other parts of the tree remain green, and this and various other facts lead me to conclude that the change of chlorophyll into a red product depends on a certain amount of reduced vitality as well as on little-understood conditions varying in different kinds of plants. Though I fully admit that there are some facts not easy to understand, yet on the whole it seems to me that these principles fairly well explain why certain leaves turn red in autumn. Slight frosts reduce their vitality in such a manner that the chlorophyll is changed by the action of the light into a red product. Thus, according to the character of the season and the nature of the plants, the first effect of the reduced vitality in the leaves is that the chlorophyll is removed so as to show their normal yellow colour, or is changed into a red pigment, or is altered into a comparatively stable dull brown green product. These are the three extreme changes, but in many cases intermediate mixed results give rise to such less perfect and well-marked tints as dirty yellows and reds.

The next series of changes is best studied in the case of those leaves which in the first instance turn to a bright yellow, and it appears to me that they depend mainly, if not entirely, on the production of deeply-coloured pigments by the oxidisation of tannic acid and other more or less colourless substances. The difference in the resulting tint seems to depend on the nature of these substances. Thus, for example, the tannic acid in the yellow oak leaves changes into a brown substance, whereas the quino-tannic acid in yellow beech leaves changes into the fine orange-brown colour which makes those trees so ornamental in autumn. On the contrary, the bright yellow poplar leaves rapidly pass to a dark dirty brown by the alteration of another constituent. Other kinds of leaves give rise to tints of an intermediate and less well-marked character. In many cases it is almost impossible to draw the line between the colour of this stage in the change and the final dark and dirty browns of dead and decaying leaves. For fine effect very much depends upon the production of each special tint in a fairly pure state, so as to show bright yellows, reds, and browns. This seems to be influenced by the character of the weather.

It is also, of course, important that the half-dead leaves should hang long on the trees, so as to develop their full colouring before being blown off by the wind.

Taking thus all the facts into consideration, it appears clear that all the bright and beautiful tints of autumn are merely the earliest stages of decomposition, and are due to the more or less considerable triumph of chemical forces over the weakened or destroyed vitality of the living plant. One cannot but feel that this is a very unpoetical way in which to regard the magnificent tints of a fine autumnal landscape, but it is no less true than that the coloured clouds of evening mark the departing day.

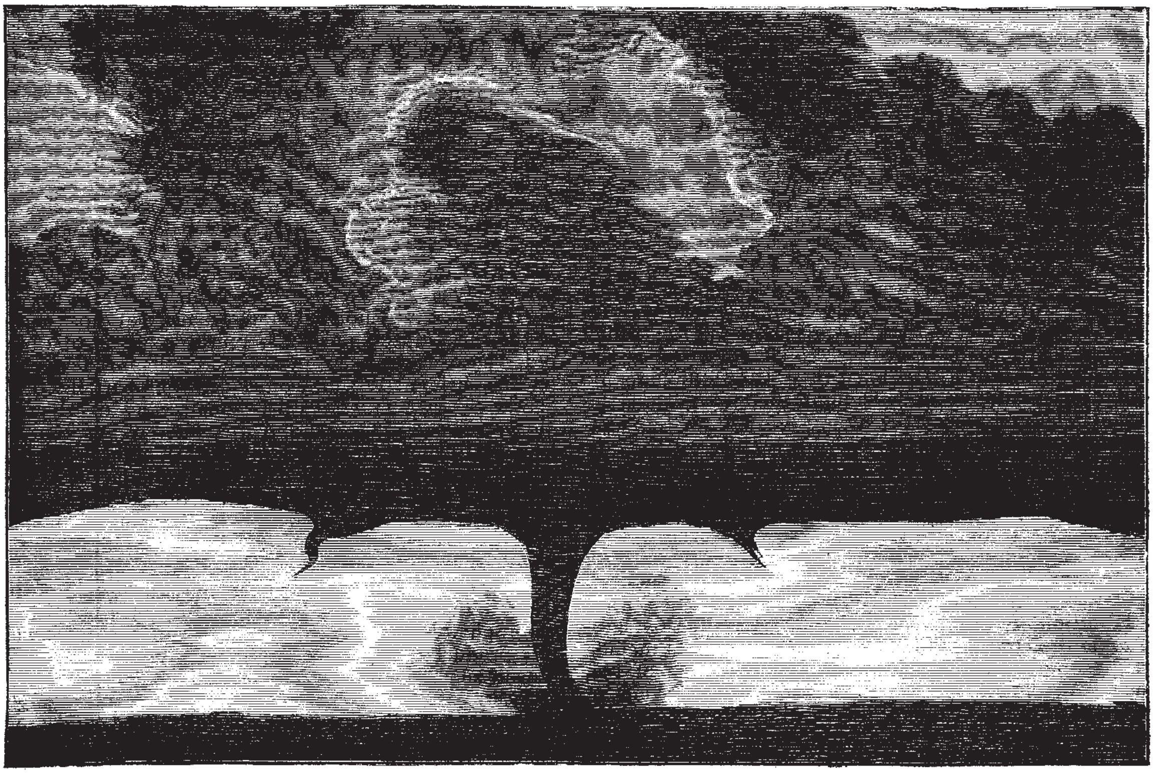
H. C. SORBY

## A TORNADO PHOTOGRAPHED

I SEND you to-day a photograph of a genuine Dakotah cyclone, or, rather, tornado, which was taken by F. N. Robinson, Howard, Miner County, D.T., August 28, 1884. The storm passed twenty-two miles west of the city. It was first noticed at 4 o'clock p.m., moving in a south-easterly direction, remaining in sight over two hours; killing several people, and destroying all property in its course. I believe it to be unique as a portrait of this class of storms, and I have thought you might care to reproduce it for NATURE.

EDWARD S. HOLDEN

Washburn Observatory, University of Wisconsin, Madison, November 14



## METEOROLOGY OF MAGDEBURG[1]

THE second report, just published, of the Meteorological Observatory of Magdeburg presents some special features of interest. The observations with the instruments in more general use are given in very convenient forms in detail and abstract.

Magdeburg was one of the first observatories to adopt the barograph of Dr. Sprung, which is certainly one of the best barographs we possess. After the purchase-cost of 40*l*., the annual outlay in working it and preparing its curves of continuous registration for the lithographer is trifling. The curves are also of high value as accurate representations of the variations of atmospheric pressure. The whole of these curves are reproduced by Dr. Assmann in an elaborate series of lithographs, on which the inch of pressure is on a scale of four inches, and the twenty-four hours of the day extend over five inches and a half. By this large scale the minuter changes of pressure are represented with great distinctness, and their relations to changes of wind, cloud, and other weather conditions can be more clearly seen. Dr. Assmann draws attention to five of the small changes from August 27 to 30 as disturbances due to the Krakatoa eruption.

The hourly values have been taken from these curves, and the means for the months calculated and added to the report. From these means and those of the previous year, a first approximation to the diurnal oscillation of the barometer for this part of Europe is obtained. The result is peculiarly interesting from the transitions it shows in the hourly variations of the summer pressure as compared on the one hand with the variations which occur at the stations of the German Seewarte on the North and Baltic Seas, and on the other with those which occur at places more in the interior of the Continent. Unfortunately for the prosecution of several inquiries raised by these differences, hourly hygrometric observations are not available from any of these first-class meteorological observatories.

Another interesting feature are the twelve lithographs which represent the continuous registrations of the sunshine recorder, on the scale of 0·4 inch for each hour These lines, which show the sunshine and inferentially the state of the sky in respect of cloud, give valuable information regarding certain hygrometric states of the atmosphere. Hence, with the aid of these and the barometric curves, the influence on the diurnal curve of

[1] "Jahrbuch der Meteorologischen Beobachtungen der Wetterwerte der Magdeburgischen Zeitung." Herausgegeben von Dr. R. Assmann. Jahrgang II. 1883. (Magdeburg, 1884).